

Adaptations to everyday work amongst nuclear operators: A safety-II approach

Robin Hamer, Gyuchan Thomas Jun and Patrick Waterson

Human Factors & Complex Systems Research Group, School of Design and Creative Arts, Loughborough University, UK

THE WORK IN CONTEXT

The safety-II movement has recently been gaining momentum. Most of the work has been conceptual in nature; however, some efforts have been made to apply Safety-II thinking in a practical manner. Current safety-II based methods have been criticised as being difficult to administer and complicated to understand. Although some research has been carried out to address safety-II, there is still some ambiguity about how the construct can be applied in practice. One way forward is to understand adaptations that occur in normal everyday work. This can be achieved by contrasting work-as-imagined and work-as-done in the context of the work environment. One understanding of this is to capture and analyse such adaptations and demonstrate value by sharing good practice. The current case study was undertaken at a major British nuclear installation. The research aims were to understand and learn from normal every day work done by nuclear operators, more specifically the adaptations they make to successfully navigate their work. A mixed methods study design (document analysis, contextual inquiry and interviews) was selected to obtain a complete understanding of work-as-imagined and work-as-done from two selected tasks, common in a nuclear power plant. Semi-structured interviews were administered to nuclear personnel who performed the tasks. These were subsequently transcribed and coded to extract the adaptations. 47 adaptations were elicited and interpreted using an analysis framework, adapted for use in the nuclear industry. The framework enabled adaptations to be classified and provided new insights into how and why the adaptations occurred. The findings were reviewed by human factors practitioners at a major UK nuclear operator. The consensus was positive, and a potential benefit of application was recognised – in particular the new information on adaptations to review tasks and rewrite standard operating procedures.

KEYWORDS

Safety-II, adaptations, nuclear

A brief outline of the work carried out

This research aims to uncover the successful adaptations and variance in everyday tasks that operators complete, often without thought. Information gathered from this research could be used to share knowledge, that may go unshared on what adaptations workers do daily. It is important to know what really happens daily (work-as-done) as opposed to what management may think occurs (work-as-imagined). Knowledge gained from this research could be fed back into management: considering the redesign of standard operating procedures and sharing information upstream (to decision makers and leaders) and downstream (between workers) in order to facilitate learning.

This case study involved three objectives: firstly, to understand the difference between work-as-imagined and work-as-done of two common activities undertaken in a nuclear power station. Secondly, to use the outcomes from the first objective to identify adaptations performed by

operative personnel. Thirdly, to use the outcomes from the second objective to formulate and classify adaptations into a framework allowing further exploratory analysis.

Two activities were selected based on their unique differences (for example one activity was selected that was routine, when the plant was in a normal operational state and one activity was selected that was periodic, when the plant was in a maintenance state). The first stage of the case study was obtaining and understanding the relevant documents for the selected tasks. The researcher used the corresponding documents to familiarise themselves with the necessary task steps and accompanying standard operating procedures. The documents also enabled the researcher to formulate observational protocol and an initial picture of work-as-imagined.

A site visit was arranged at a large British nuclear installation where the second phase of the case study took place. An activity ‘walk down’ for each task was performed which included observational data capture and contextual inquiry – performing the activities by the researchers as if they were executing the tasks and querying the processes and procedures used. This provided a complete picture of work-as-imagined.

The final phase of the case study were semi-structured interviews with personnel who completed the work. The purpose of the interviews was to uncover how the standard operating procedures were interpreted and applied on site by each operator, which enabled adaptations and variance to be captured. Five participants were selected using purposive sampling and were subjected to a 45-minute interview. The interview questions were designed to extract the various adaptations personnel made by revisiting each task and asking how they performed the work. Interviews were recorded, transcribed and thematically coded to extract adaptations.

Findings/solutions (the outcome)

From the interviews with nuclear personnel, 47 adaptations were elicited and interpreted using an analysis framework, adapted for use within the nuclear industry. The framework is a synthesis of the following frameworks and models: Systems Engineering Initiative for Patient Safety (SEIPS 2.0) (Holden et al., 2013); the Concepts for Applying Resilience Engineering model (CARE) (Anderson et al., 2016); and the Perceptual Cycle model (Neisser, 1976). The framework enabled the classification of adaptations and afforded new insights regarding how and why adaptations occurred (for example the adaptation triggers, the justification of the adaptation, the method of action and the outcome of the adaptation on system performance).

Impact

The preliminary results and analysis were reviewed by human factors practitioners at a major UK nuclear operator. Initial comments reiterated that an adaptation classification framework would be beneficial to the industry as it would allow more information to be gained on a previously unexplored topic area. Overall, comments were positive, particularly regarding using information on adaptations within a classification framework to review tasks and rewrite procedures.